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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/768,195	01/23/2001	Hiroki Endo	KN1-145-A	1960

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CARRIER, BLACKMAN & ASSOCIATES, P.C.  
24101 NOVI ROAD #100  
NOVI, MI 48375

EXAMINER
KIELIN, ERIK J

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 02/21/2002

7

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/768,195

Applicant(s)

ENDO ET AL.

Examiner

Erik Kielin

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 January 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 January 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Priority*

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.
2. Figures 1(a) through 1(h) should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### *Specification*

3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested:

A method of forming a coating on a plate-like workpiece  
using temperature and oxygen concentration control.

4. The amendment filed 1/23/01 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

Changing the word "PRIOR" to "RELEVANT" introduces new matter. The scope of the terms are different, and Applicant has already admitted on the record that content of the section is "PRIOR ART" -- not "RELEVANT ART." Furthermore, this section of Applicant's specification describes the notoriously well known, general, copper damascene process.

Applicant is required to cancel the new matter in the reply to this Office Action.

5. The disclosure is objected to because of the following informalities:
- on p. 1, line 12, replace "to reduce a" with --a reduction in-- for clarity;
  - on p. 3, line 15, remove "treated to be" for clarity;
  - on p. 4, line 20, before "out" insert "and" for clarity;
  - on p. 11, line 8, after "react" insert --with-- for clarity
- Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 4-6 and 10-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 4-7 require the interlayer insulation film to be formed "by a damascene method," but the specification and independent claim 1 indicate that the film is formed by applying a raw material and then heating to 400 °C. This is not a damascene method, as shown in Applicant's prior art Figs. 1(a)-1(h). Examiner believes that Applicant means that the interlayer insulation film formed by the method of claim 1 is *further processed* by a damascene method.

Claims 10-12 are indefinite for depending from claims 4-7.

For the remainder of the examination, Examiner assumes that "by a damascene method" is consistent with Applicant's specification and figures.

***Claim Rejections - 35 USC § 102***

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

9. Claims 1, 2, and 9 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent Application Publication 2001/0029111 A1 (**You et al.**).

Regarding claim 1, **You** discloses a method of forming a coating film in an isolated process chamber which allows spin-on of low dielectric materials, solvent evaporation and curing, all under a controlled environment comprising,

applying a raw material of low dielectric constant (paragraphs [0072]-[0073]) onto a surface of a plate-like material 208 (Fig. 2) to be treated;

reducing the oxygen concentration in the atmosphere surrounding the plate-like material to be less than or equal to 1% before a surface temperature of said plate-like material to be treated rises to 200 °C (paragraph [0153]); thereafter

heating said plate-like material to be treated to a temperature greater than or equal to 400 °C (paragraphs [0146]-[0147]); and then

maintaining the oxygen content in the atmosphere to be less than or equal to 1% until the surface temperature of said plate-like material to be treated lowers to 200 °C (paragraph [0153]).

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Note paragraph [0153] which states, "The combination of step-ramp curing and an **inert gas environment** for **heating, high temperature cure, and cooling steps** can provide thin films with high mechanical strength and minimized oxidation, therefore leading to thin films having lower dielectric constants, such as below about 3.0." (Emphasis added.) Accordingly, the heating, curing, and cooling steps in the above mentioned paragraphs is carried out in an atmosphere of 0% oxygen because an "inert atmosphere" is used. Note also that the same purpose for using the no/low-oxygen environment in **You** is the same as that indicated by Applicant. (See instant specification section entitled "SUMMARY OF INVENTION.")

Regarding claim 2, Fig. 1a shows purging gas lines 130 to control the chamber atmosphere. Nitrogen gas as the inert atmosphere is disclosed in paragraph [0153].

Regarding claim 9, see paragraphs [0072]-[0073] and [0139].

### ***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 3, 7, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over **You** in view of US 5,431,700 (**Sloan**).

The prior art of **You**, as explained above, teaches all of the features of the claims except for controlling the surface temperature of the wafer by selectively moving the wafer relative to a

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hot-plate positioned over a cold plate (claims 3 and 7) while the moving is carried out by a elevator means extending through the cold plate (claim 8), as shown in Applicant's Fig. 2.

**Sloan** teaches a method of controlling the surface temperature of a semiconductor wafer 12 (plate-like material) for heating and for cooling operations using a hot plate 26 positioned over a cooling plate 42 with elevator means 70 having pins 62 extending through the cooling plate (cover Fig.; paragraph bridging cols. 4-5).

It would have been obvious to one of ordinary skill at the time of the invention to use the temperature control method taught by **Sloan** in the method disclosed by **You** for the many beneficial reasons indicated in **Sloan**, such as uniform heating, reduced contamination, etcetera.. (See **Sloan** Abstract.)

Although each of the structural features of Applicant's claims is taught in **Sloan**, note that it has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. Ex parte Pfeiffer, 1962, C.D. 408 (1961). Accordingly, Applicant should phrase the claims having apparatus structure, such that the structural elements are manipulative of the method.

12. Claims 4 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over **You** in view of either of Applicant's admitted prior art (**AAPA**) and **Wolf**, Silicon Processing for the VLSI Era, Vol. 2 : Process Integration, Lattice Press: Sunset Beach, CA 2000, pp. 797-801.

The prior art of **You**, as explained above, teaches all of the features of the claims except for further processing an interlayer insulation layer by a damascene method.



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Each of **AAPA** and **Wolf** teaches the reasons it is common in the art to process an interlayer insulation layer of low dielectric constant by a damascene method, in order to interconnect semiconductor devices. (See instant specification, section entitled "Description of Prior Art" and associated Figs. 1(a)-1(h). See also **Wolf**, pp. 797-801 -- especially Fig. 15.60).

It would have been obvious to one of ordinary skill at the time of the invention to process the interlayer insulation film of **You** by a damascene method as taught by either of **AAPA** and **Wolf** in order to form interconnect for semiconductor devices, which is essential in the art and because the **You** method is for the formation of, *inter alia*, interlevel dielectrics for semiconductor devices (Abstract; paragraph [0009]).

Regarding claim 10, **You** discloses that the interlayer insulation film beneficially has a low dielectric constant of 3.0 or less, as noted above.

13. Claims 5-6 and 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over **You** in view of **Sloan** as applied to claims 1-3 above, and further in view of either of **AAPA** and **Wolf**.

The prior art of **You**, as explained above, teaches all of the features of the claims except for further processing an interlayer insulation layer by a damascene method.

Regarding claims 5 and 6, either of **AAPA** and **Wolf** is applied as above.

Regarding claims 11-12, **You** discloses that the interlayer insulation layer beneficially has a low dielectric constant of 3.0 or less, as noted above.

***Conclusion***

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 6,261,365 B1 (**Matsuyama et al.**) teaches a method of forming a low dielectric constant ILD under reduced oxygen atmosphere to prevent oxidation at elevated temperatures except for the apparatus limitations, but does teach a heating and cooling plates, separately located in the chamber (Abstract and cover Fig.).

Patent Application Publication US 2002/0006876 A1 (**Hongo**) discloses each of the features of the instant invention except that the ILD 102 (Fig. 1A) is low dielectric constant material, but does not qualify as prior art. (See Figs. 1A-1C for the damascene processing; Fig. 77 for the heating/cooling apparatus; paragraphs [0301]-[0306].)

US 5,802,856 (**Schaper et al.**) teaches that the apparatus for heating/cooling the semiconductor wafer is known in the art. (See Fig. 2.)

US 6,225,240 B1 (**You et al.**) provides an essentially equal disclosure to the You reference applied above.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached at 703-306-2417. The fax phone numbers for the

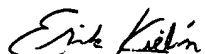
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organization where this application or proceeding is assigned are 703-306-7722 for regular communications and 703-306-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-3431.



Erik Kielin

February 16, 2002